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Wong

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- (54) **TALAR DOME FIXATION STEM**
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USPC 623/21.18, 17.11–17.16
See application file for complete search history.

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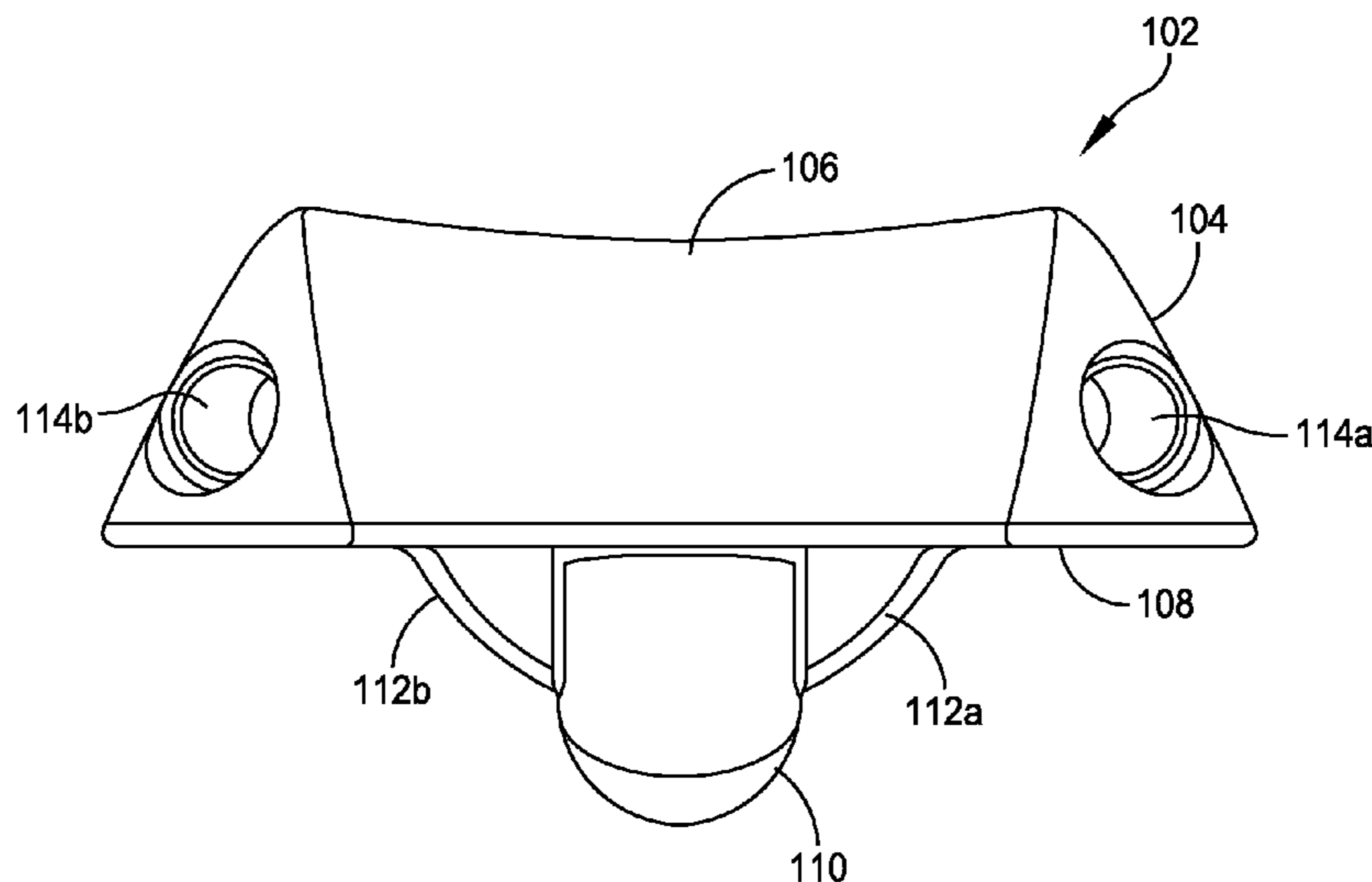
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(57) **ABSTRACT**

A talar implant is disclosed. The implant comprises a body comprising a bone contact surface and an articulation surface. A stem extends longitudinally from the bone contact surface. The stem comprises one or more features sized and configured to prevent rotational movement, anterior/posterior movement, and medial/lateral movement. The stem is configured to be received within a hole a talus.

18 Claims, 7 Drawing Sheets



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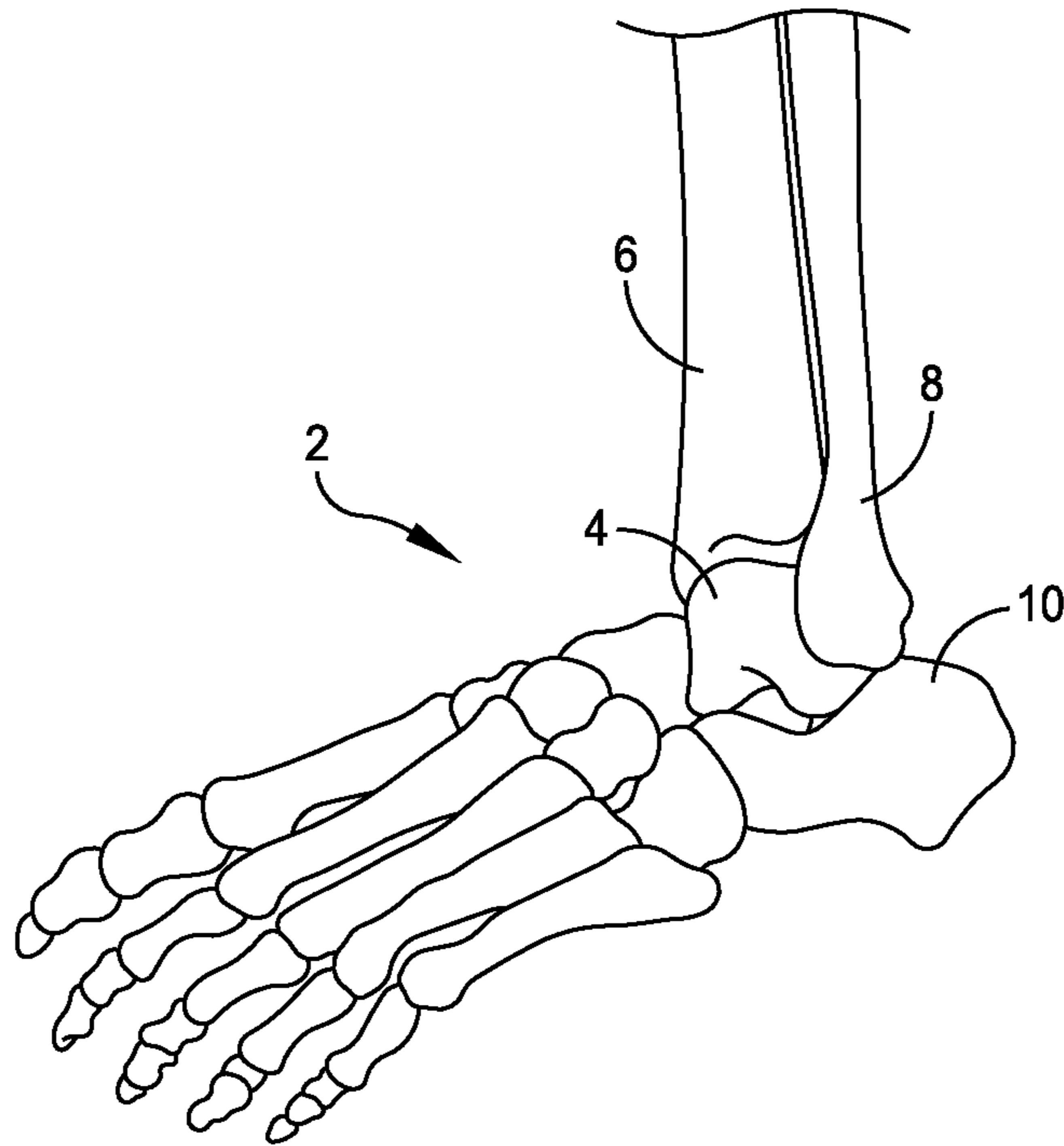


FIG. 1

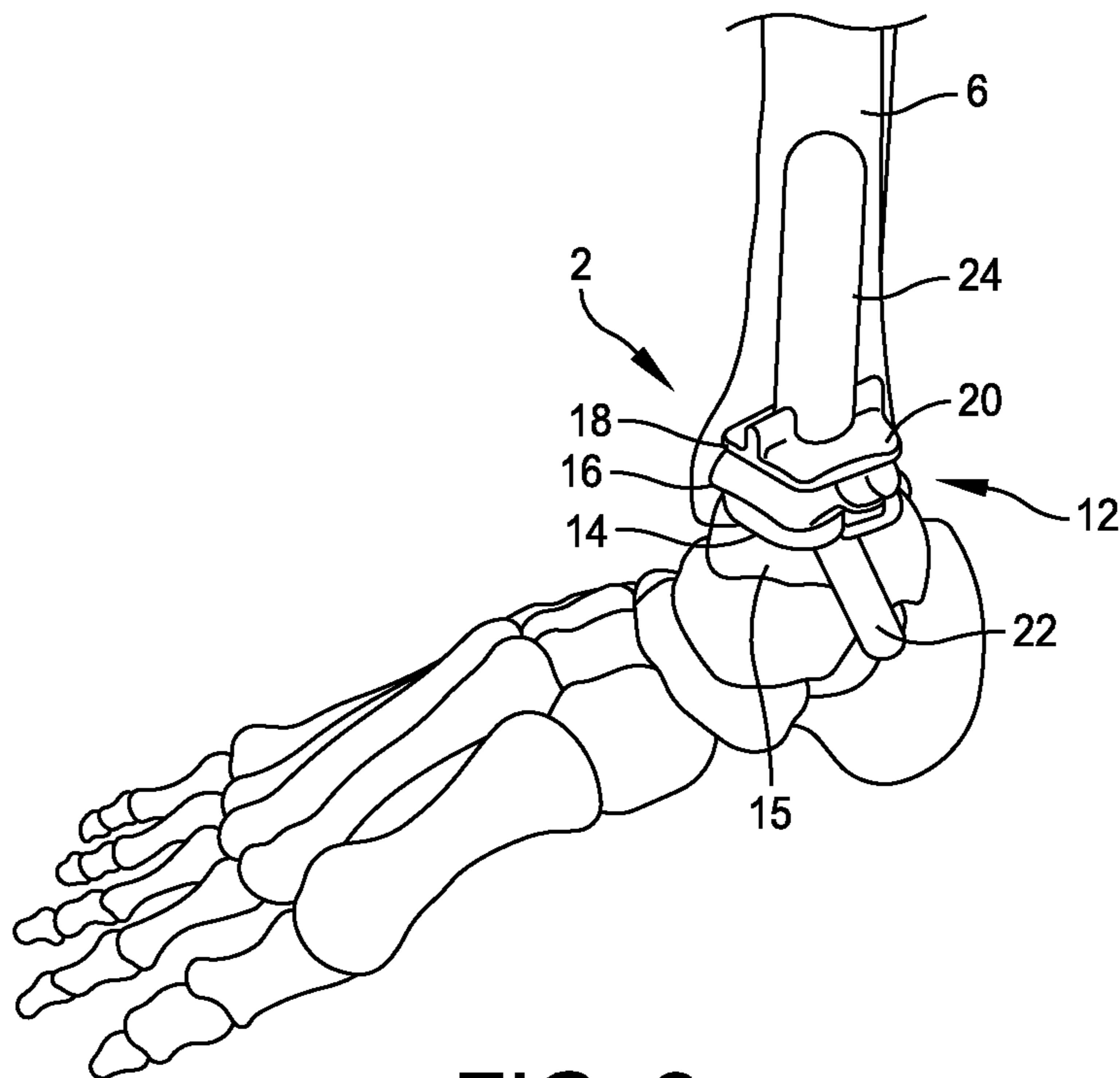


FIG. 2

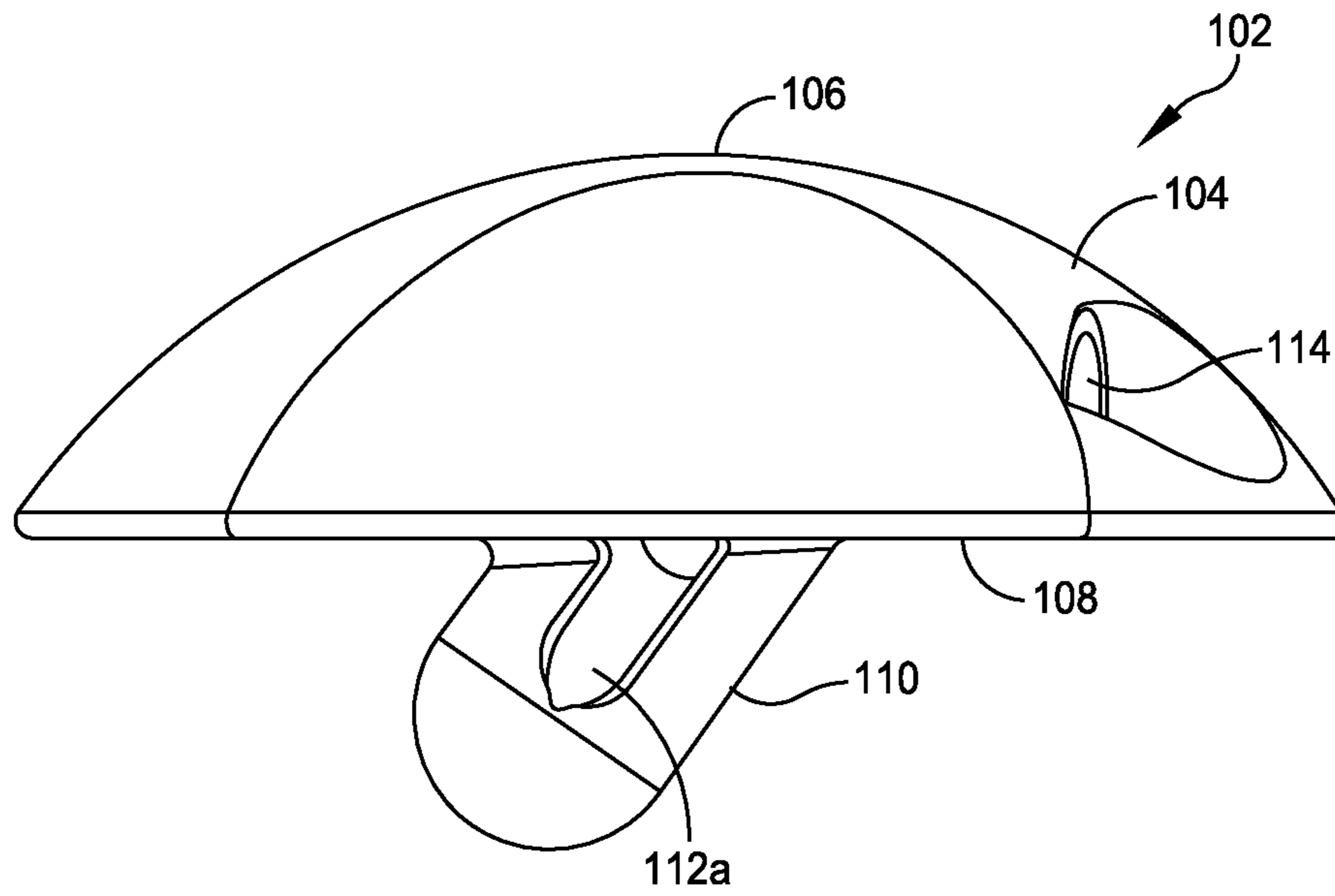


FIG. 3

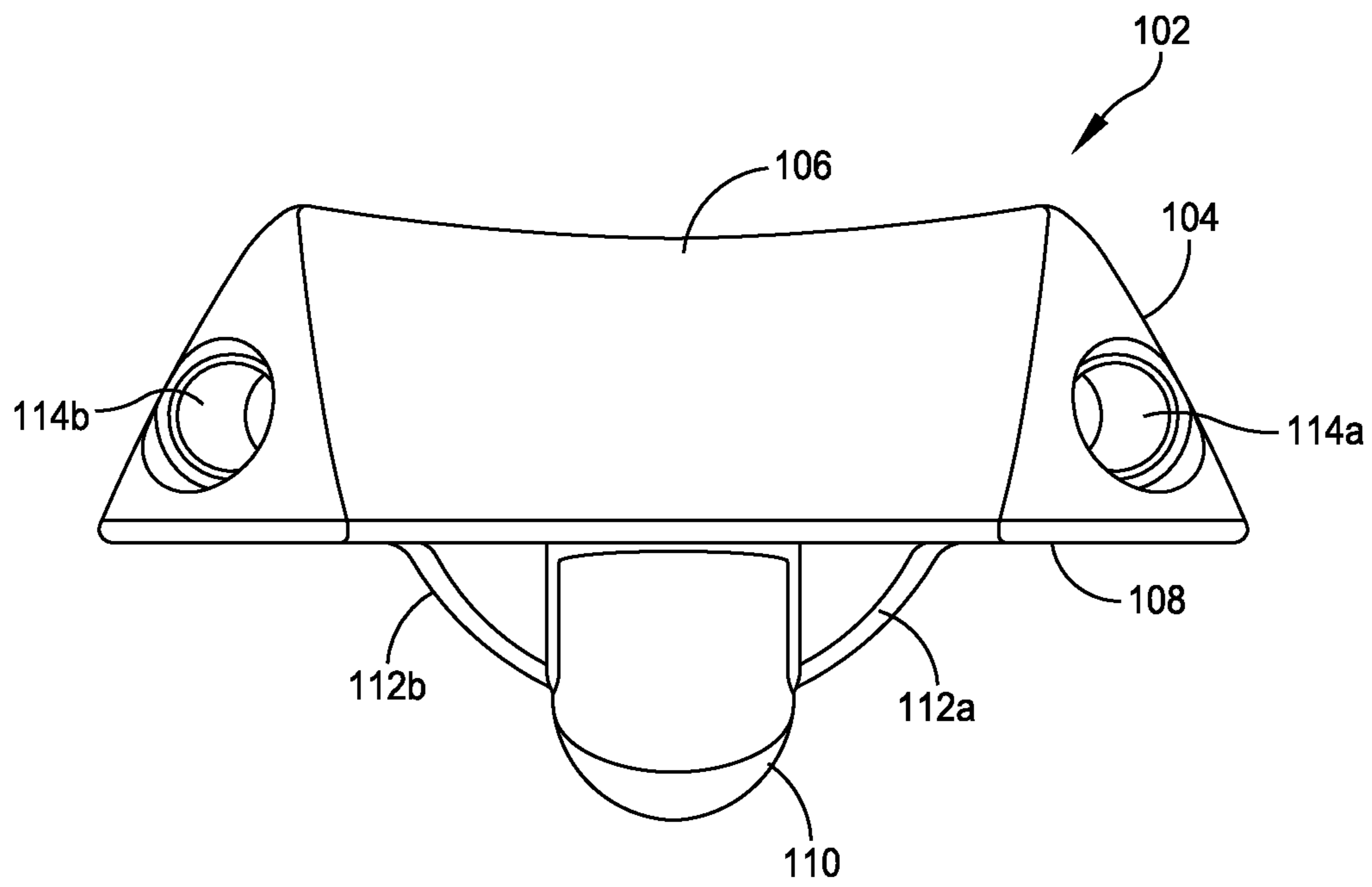


FIG. 4

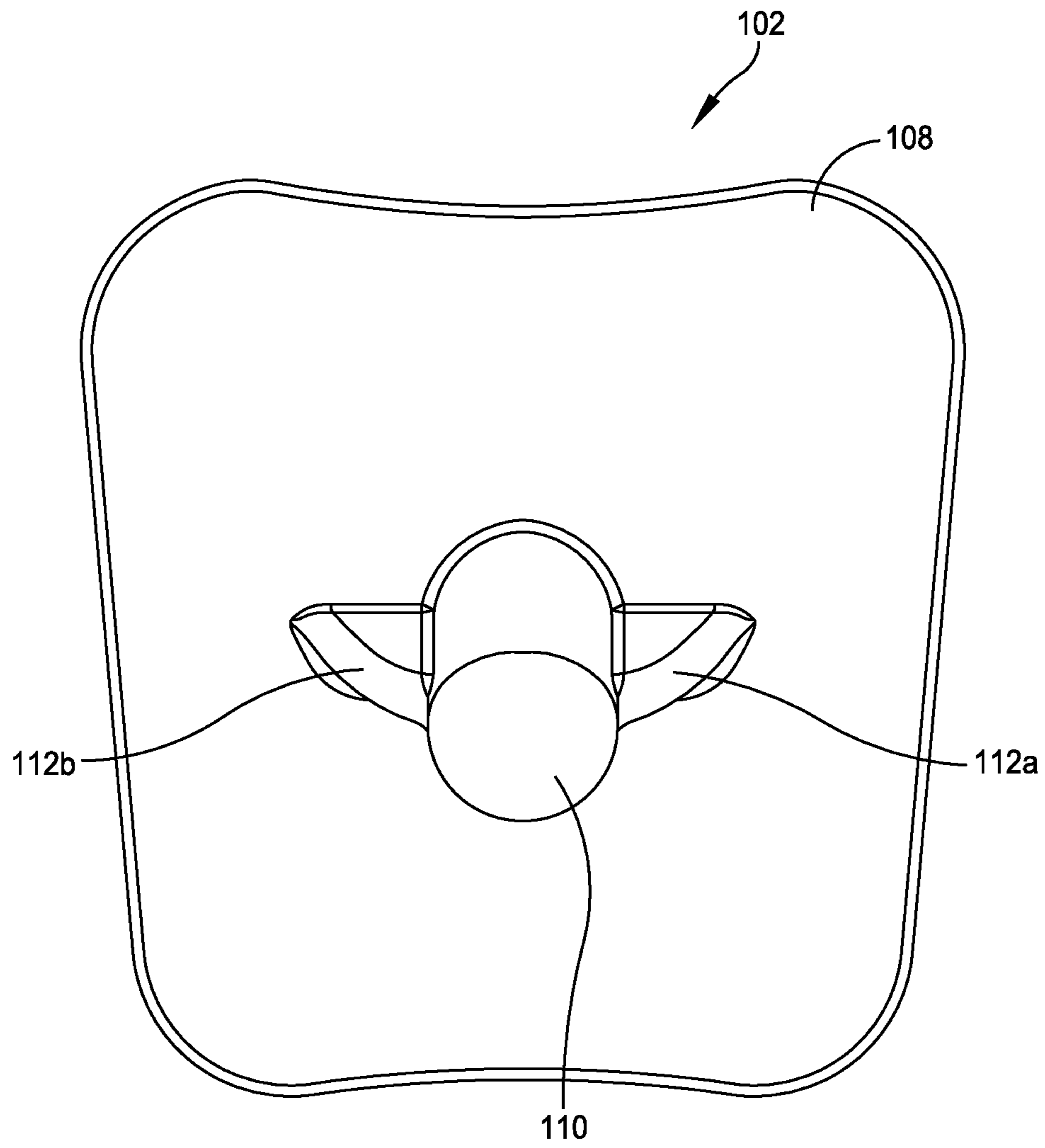


FIG. 5

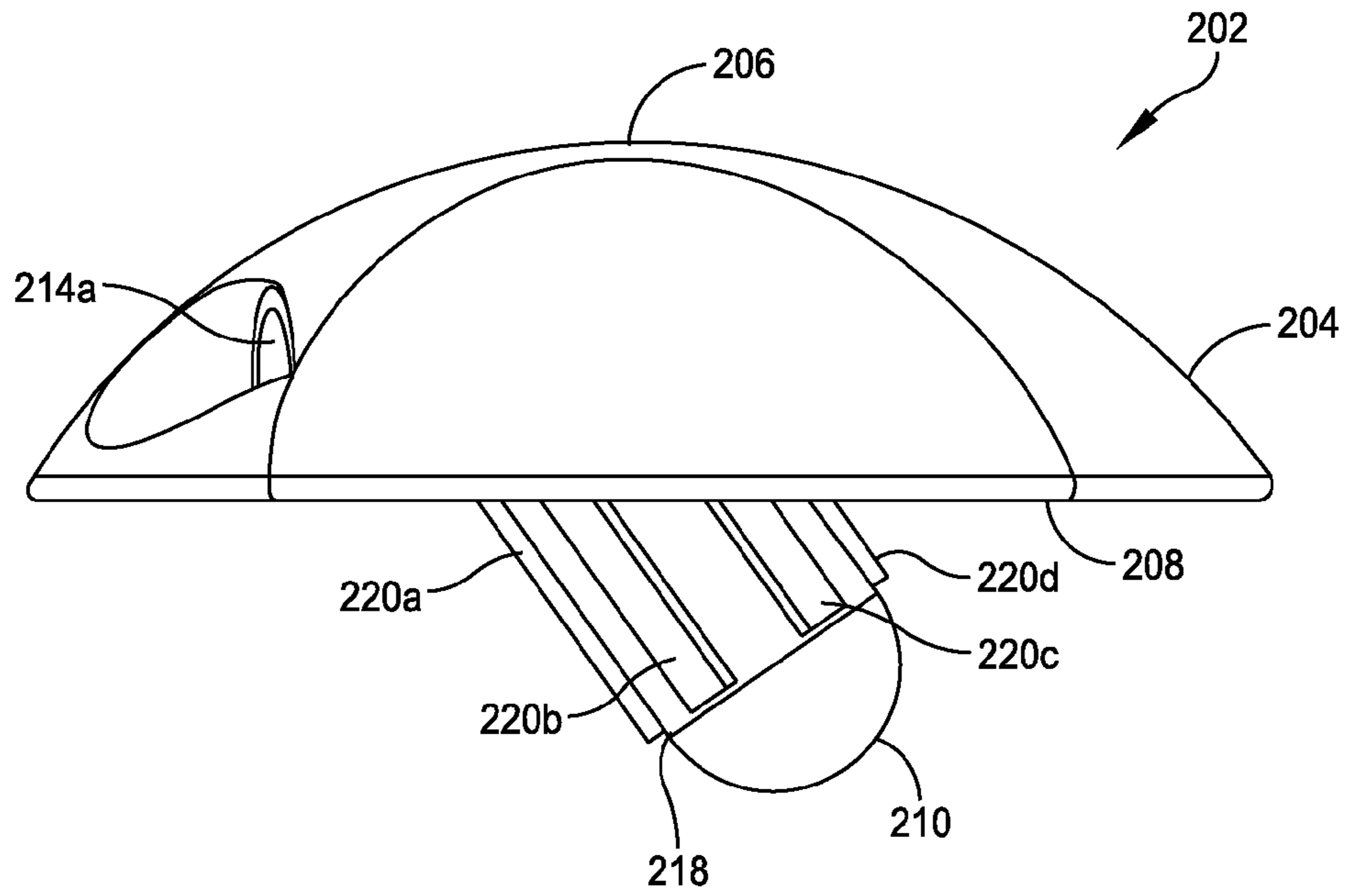


FIG. 6

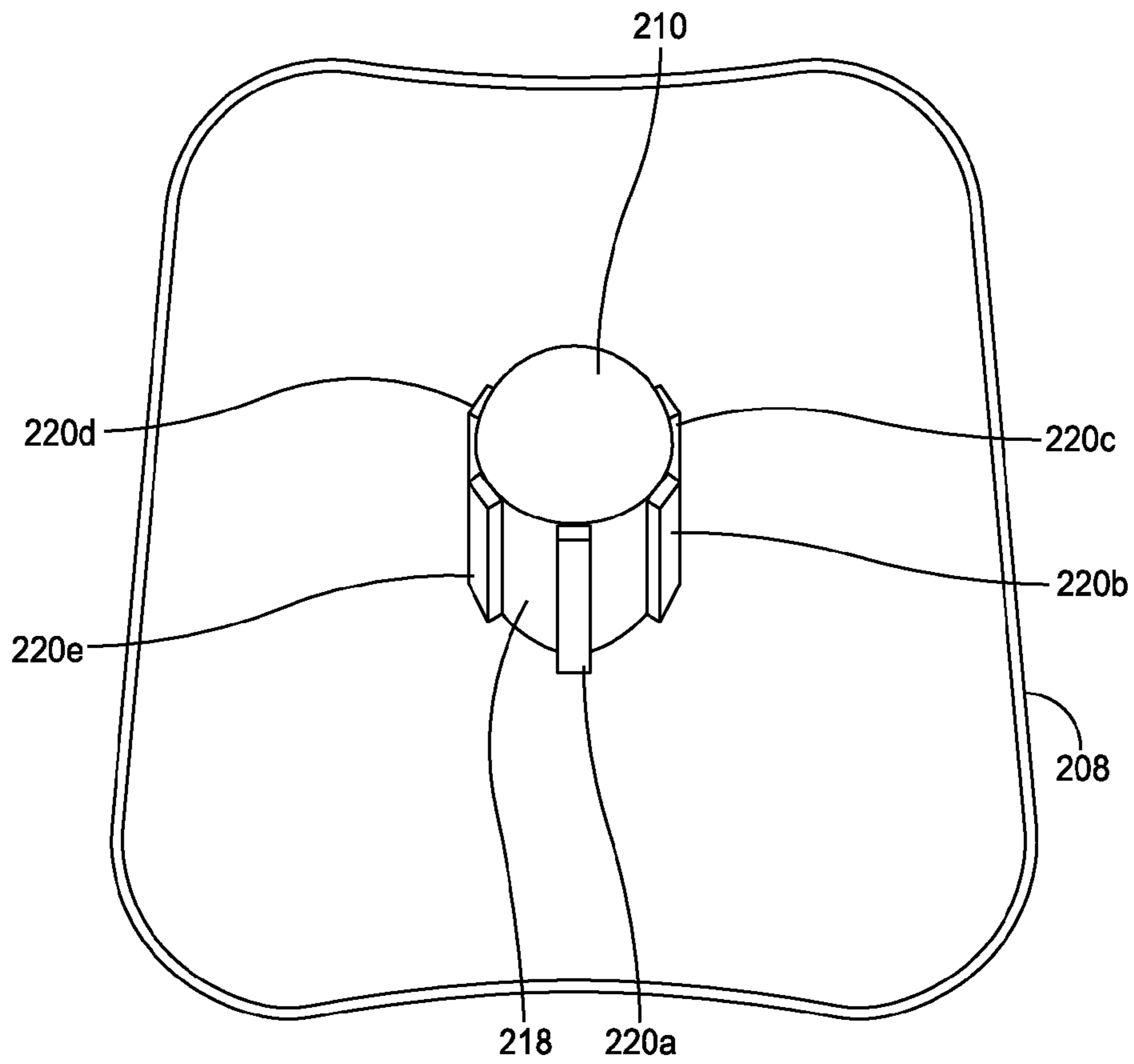


FIG. 7

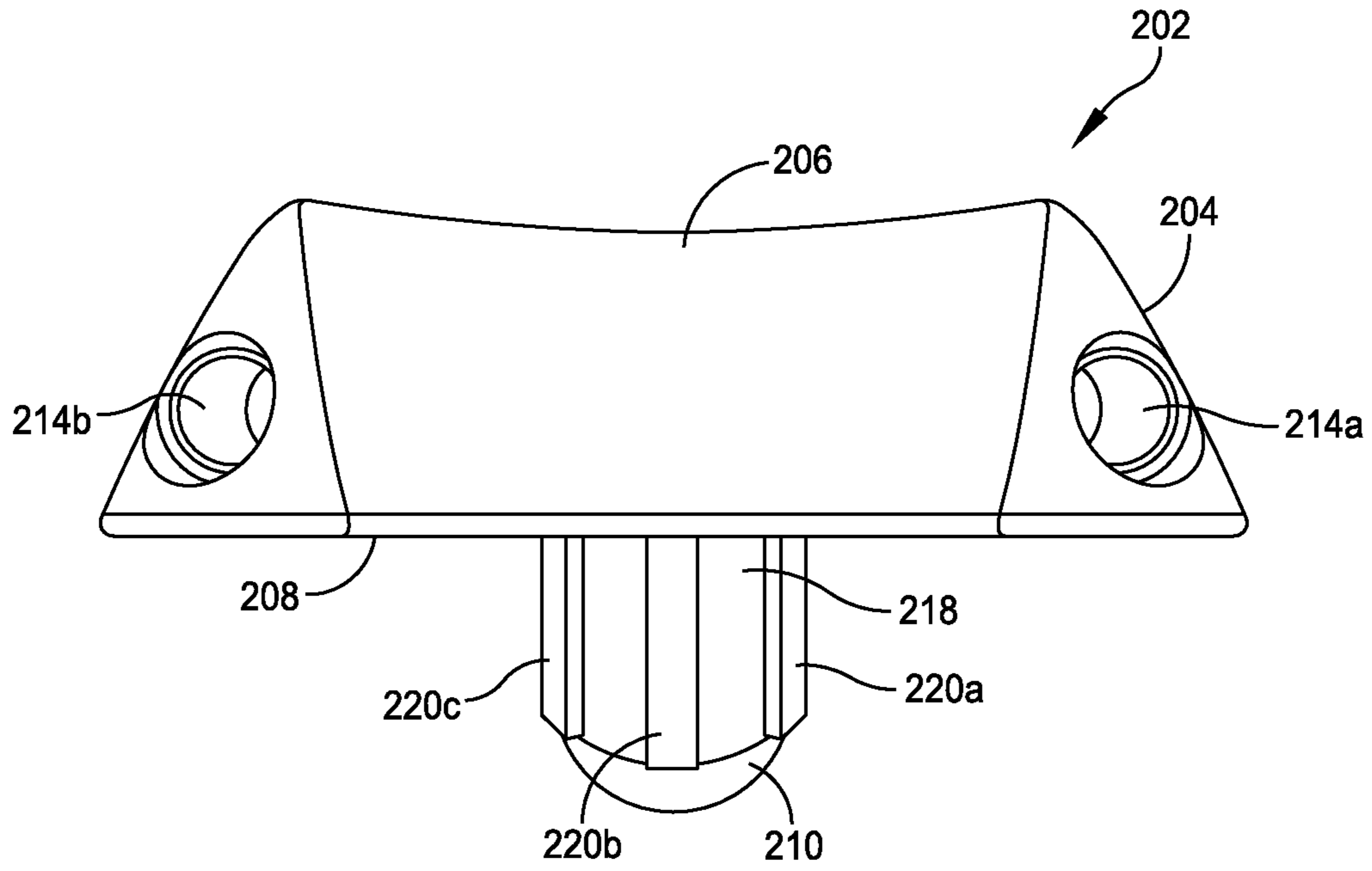


FIG. 8

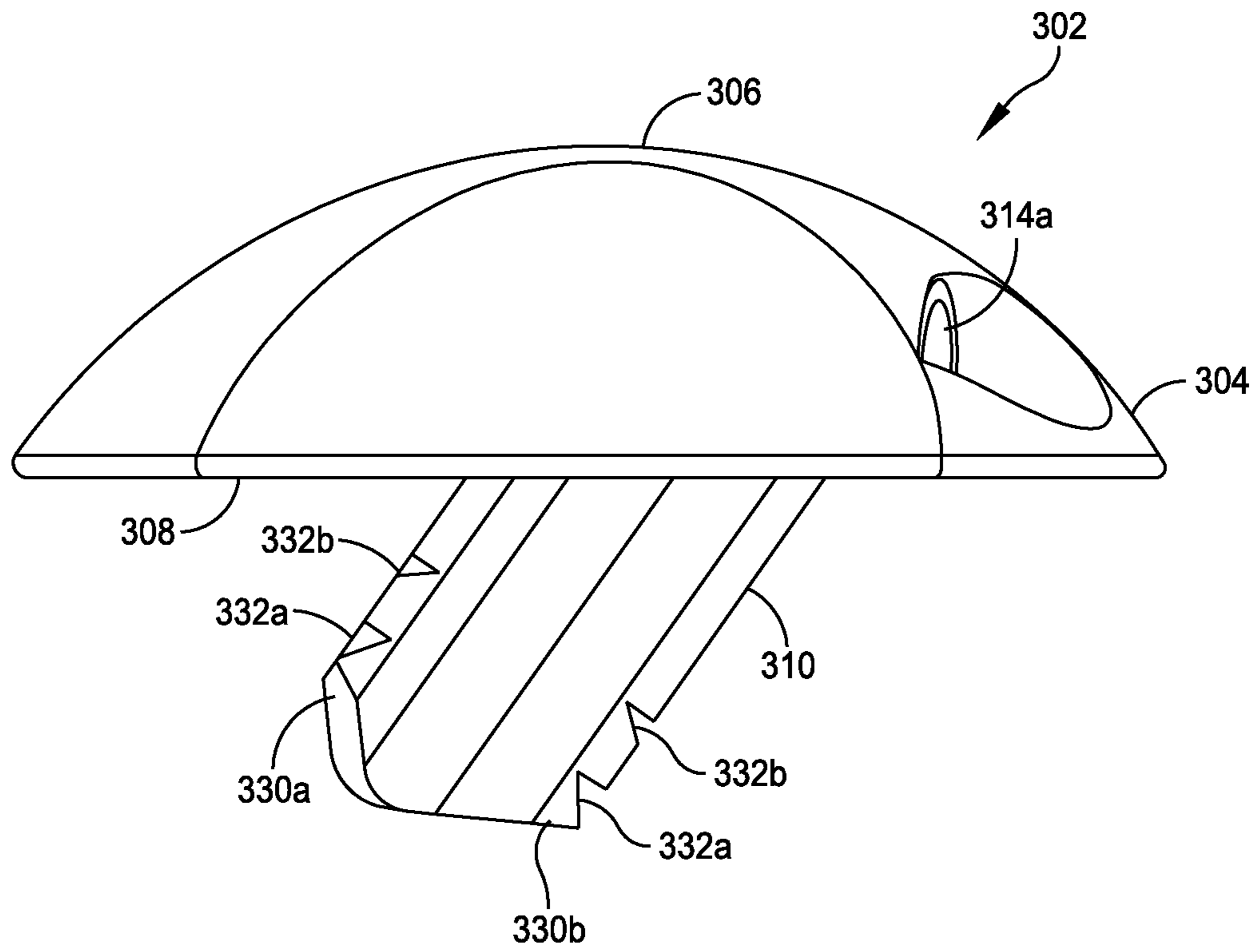


FIG. 9

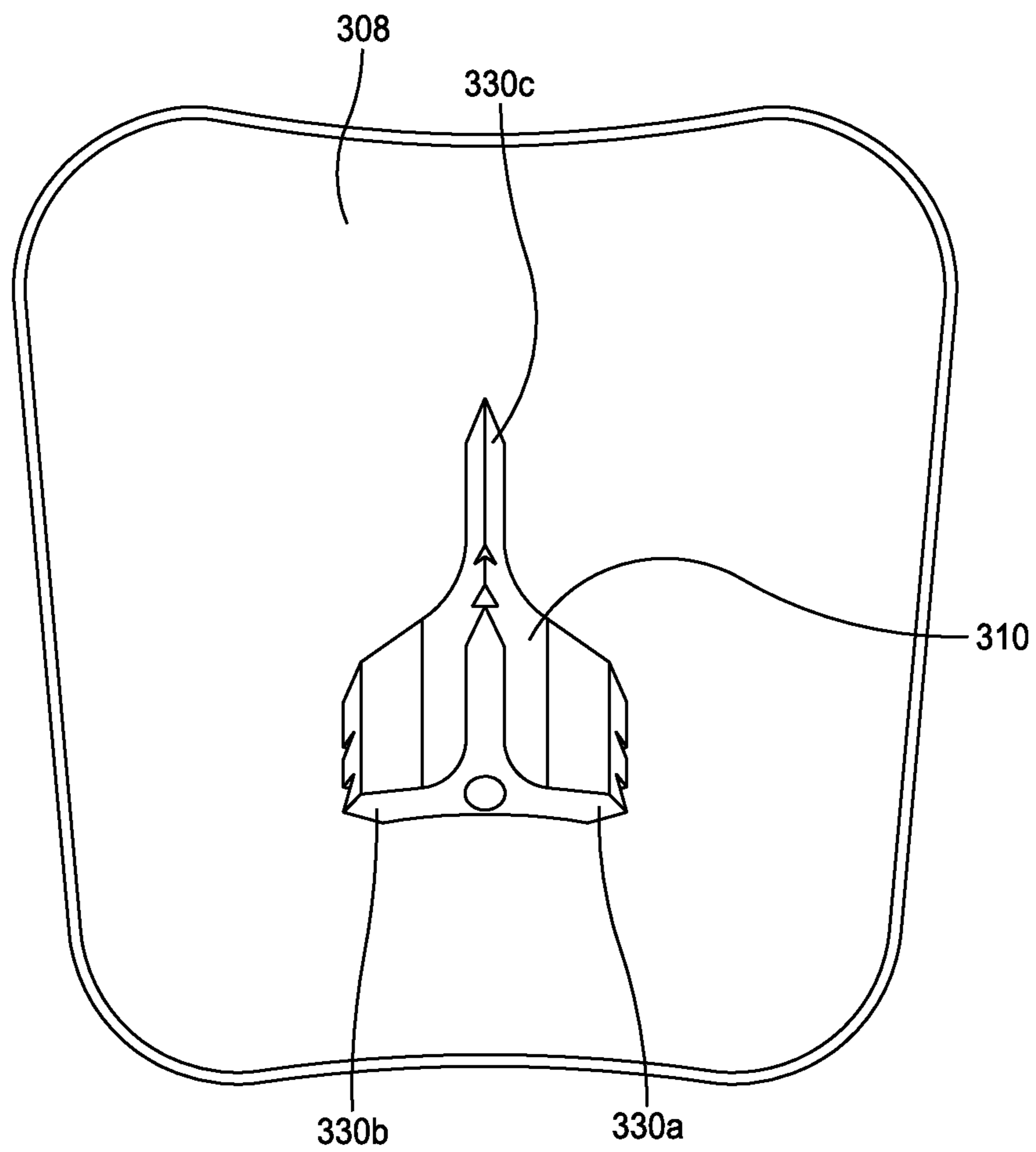


FIG. 10

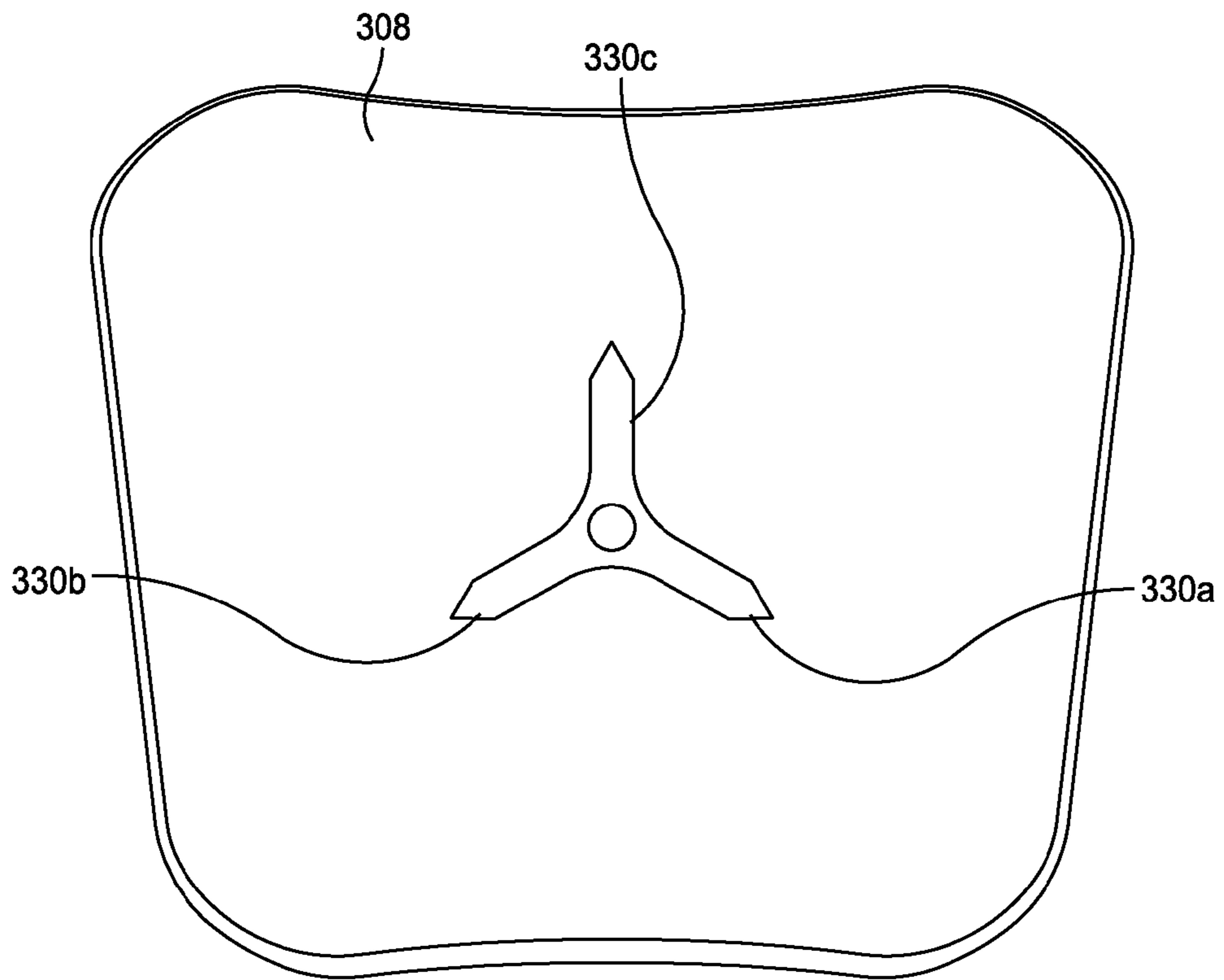


FIG. 11

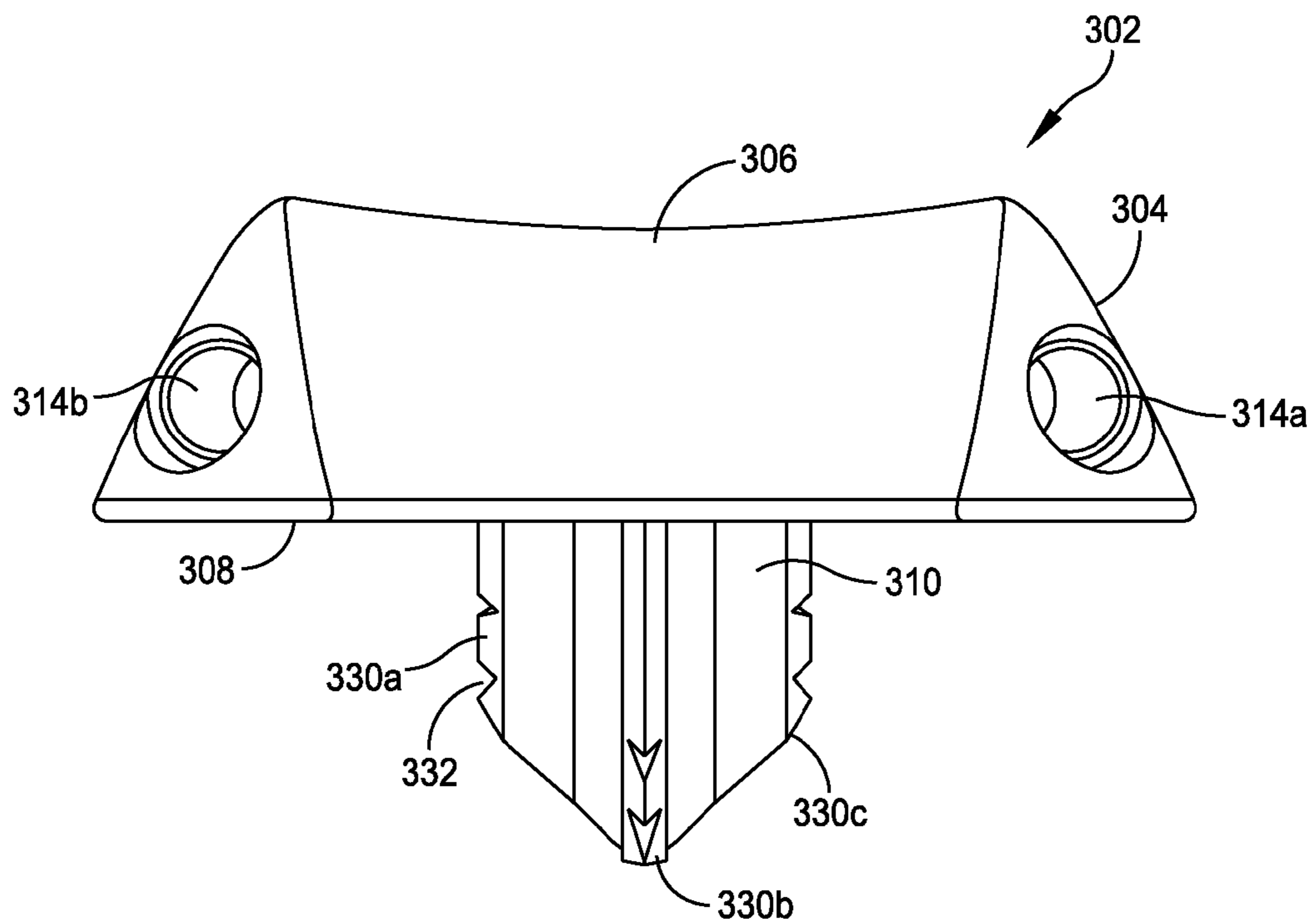


FIG. 12

1**TALAR DOME FIXATION STEM****CROSS REFERENCE TO RELATED APPLICATIONS**

This application is a national phase entry under 35 U.S.C. 371 of international patent application No. PCT/US14/64572, the entirety of which is incorporated herein by reference.

BACKGROUND

An ankle joint may become severely damaged and painful due to arthritis, prior ankle surgery, bone fracture, osteoarthritis, and/or one or more additional conditions. Options for treating the injured ankle have included anti-inflammatory and pain medications, braces, physical therapy, joint arthrodesis, and total ankle replacement.

Total ankle replacement generally comprises two or more components—one portion coupled to the tibia and one portion coupled to the talus. The components comprise articulation surfaces sized and configured to mimic the range of motion of the ankle joint. For example, the talar portion may comprise a component sized and configured to mimic the talar dome and the tibial portion may comprise an articulation surface configured to mimic articulation of the tibia.

Installation of the total ankle replacement may comprise forming one or more holes, slots or cuts in a bone. For example, a hole may be drilled through the talus and into the tibia to create a channel for inserting a tibial stem. As another example, slots can be reamed with an end mill or punch having a guide. In some installations, additional bone is removed from the talus to make space for a talar stem extending from the talar portion.

SUMMARY

In some embodiments, a bone implant is disclosed. The bone implant generally comprises a body and a stem. The body comprises a bone contact surface and an articulation surface. The stem extends longitudinally from the bone contact surface. At least one fin is coupled to the stem and the body to provide anterior/posterior stability, rotational stability, medial/lateral stability, and axial resistance.

In some embodiments, a bone implant is disclosed. The bone implant generally comprises a body and a stem. The body comprises a bone contact surface and an articulation surface. The stem extends longitudinally from the bone contact surface. A spline is formed about the stem. The spline is sized and configured to provide anterior/posterior stability, rotational stability, medial/lateral stability, and axial resistance.

In some embodiments, a bone implant is disclosed. The bone implant generally comprises a body and a stem. The body comprises a bone contact surface and an articulation surface. The stem extends longitudinally from the bone contact surface and comprises a triangular stem having a first leg, a second leg, and a third leg. At least one of the first leg, the second leg, the third leg, defines a plurality of serrations formed thereon. The triangular stem and the plurality of serrations provide anterior/posterior stability, rotational stability, medial/lateral stability, and axial resistance.

BRIEF DESCRIPTION OF THE FIGURES

The features and advantages of the present invention will be more fully disclosed in, or rendered obvious by the

2

following detailed description of the preferred embodiments, which are to be considered together with the accompanying drawings wherein like numbers refer to like parts and further wherein:

- 5 FIG. 1 illustrates an anatomic view of an ankle joint.
 FIG. 2 illustrates one embodiment of an ankle joint having a total ankle replacement system therein.
 FIG. 3 illustrates a side view of one embodiment of a talar dome comprising a stem having a plurality of fins.
 10 FIG. 4 illustrates a front view of the talar dome of FIG. 3.
 FIG. 5 illustrates a bottom view of the talar dome of FIG. 3.
 FIG. 6 illustrates a side view of one embodiment of a talar dome comprising a stem having a spline formed thereon.
 15 FIG. 7 illustrates a bottom view of the talar dome of FIG. 6.
 FIG. 8 illustrates a front view of the talar dome of FIG. 6.
 FIG. 9 illustrates a side view of one embodiment of a talar dome comprising a triangular stem defining a plurality of serrated blades.
 20 FIG. 10 illustrates an angled bottom view of the talar dome of FIG. 9.
 FIG. 11 illustrates a bottom view of the talar dome of FIG. 9.
 25 FIG. 12 illustrates a front view of the talar dome of FIG. 9.

DETAILED DESCRIPTION

- 30 The description of the exemplary embodiments is intended to be read in connection with the accompanying drawings, which are to be considered part of the entire written description. In the description, relative terms such as “lower,” “upper,” “horizontal,” “vertical,” “proximal,” “distal,” “above,” “below,” “up,” “down,” “top” and “bottom,” as well as derivatives thereof (e.g., “horizontally,” “downwardly,” “upwardly,” etc.) should be construed to refer to the orientation as then described or as shown in the drawing under discussion. These relative terms are for convenience of description and do not require that the apparatus be constructed or operated in a particular orientation. Terms concerning attachments, coupling and the like, such as “connected” and “interconnected,” refer to a relationship wherein structures are secured or attached to one another either directly or indirectly through intervening structures, as well as both movable or rigid attachments or relationships, unless expressly described otherwise.

- The present disclosure generally provides a bone implant for use with a joint replacement system. The bone implant comprises a body having a bone contact surface and an articulation surface. A stem extends longitudinally from the bone contact surface. The stem comprises one or more features configured to provide rotational, translational, and pull-out resistance to the implant with respect to a bone. The stem and the one or more features are configured to interface with a hole formed in a bone, such as, for example, a talus.

- FIG. 1 illustrates an anatomic view of an ankle joint 2. The ankle joint 2 comprises a talus 4 in contact with a tibia 6 and a fibula 8. A calcaneus 10 is located adjacent to the talus 4. In total ankle replacements, the talus 4 and the tibia 6 may be resected, or cut, to allow insertion of a talar implant and a tibial implant. FIG. 2 illustrates the ankle joint 2 of FIG. 1 having a total ankle replacement system 12 inserted therein.

- 65 The total ankle replacement system 12 comprises a talar platform 14 and a tibial platform 18. The talar platform 14 comprises a body 15 defining a talar articulation surface 16

(or talar dome). A stem **22** extends into the talus **4** to anchor the talar platform **14** to the talus **4**. The tibial platform **18** is sized and configured for installation into the tibia **6**. The tibial platform **18** comprises a body having an articulation surface **20** and a tibial stem **24** extending into the tibia **6** to anchor the tibial platform **18**. The talar joint surface **16** and the tibial joint surface **20** are mutually sized and configured to articulate. The joint surfaces **16**, **20** replace the natural ankle joint surfaces, which are removed, to restore a range of motion and a height that mimics the natural joint. One or more holes may be formed in the tibia and/or the talus prior to and during insertion of the tibial implant **18** or the talar implant **12**. For example, in some embodiments, a hole is drilled starting in the bottom of the talus, extending through the talus and into the tibia. The hole may comprise, for example, a 6 mm hole configured to receive the stem **24** of the tibial platform **18**.

The joint surfaces **16**, **20** may be made of various materials, such as, for example, polyethylene, high molecular weight polyethylene (HMWPE), rubber, titanium, titanium alloys, chrome cobalt, surgical steel, and/or any other suitable metal, ceramic, sintered glass, artificial bone, and/or any combination thereof. In some embodiments, the joint surfaces **16**, **20** may comprise a coated surface. For example, in some embodiments, the joint surfaces **16**, **20** may be plasma sprayed with a porous material, such as, for example, a biofoam material. The joint surfaces **16**, **20** may comprise different materials. For example, the tibial joint surface **20** may comprise a plastic or other non-metallic material and the talar joint surface **16** may comprise a metal surface. Those skilled in the art will recognize that any suitable combination of materials may be used.

FIG. **3** is a side view of one embodiment of an implant **102** comprising a stem **110** having one or more fins **112a**, **112b**. The implant **102** comprises a body an articulation surface **106** and a bone contact surface **108**. The joint articulation surface **106** is sized and configured to allow articulation of a bone and/or implant in contact with the articulation surface **106**. For example, in some embodiments, the implant **102** comprises a talar implant. The articulation surface **106** is sized and configured to allow articulation of a tibia and/or tibial implant in contact with the implant **102** after installation. In other embodiments, the articulation surface **106** may be sized and configured to allow articulation of additional and/or alternative bones and/or implants.

The body **104** further comprises a bone contact surface **108** located opposite from the articulation surface **106**. The bone contact surface **108** is configured to interface with a bone surface prepared during surgery. For example, in some embodiments, the bone contact surface **108** is configured to interface with a resected bone surface, such as a resected talus, to couple the implant **102** to the bone. In some embodiments, the bone contact surface **108** comprises a generally planar surface. In other embodiments, the bone contact surface **108** comprises a concave surface. In some embodiments, only a portion of the bone contact surface **108**, such as, for example, an outer perimeter, interfaces with the bone surface prepared during surgery. The bone contact surface **108** may comprise a surface lip located at the edge of the implant **102** sized and configured to maintain the implant **102** in a proper location and/or alignment with respect to the bone. In some embodiments, the bone contact surface **108** comprises multiple bone contact points/surfaces.

A stem **110** extends longitudinally at an angle from the bone contact surface **108**. The stem **110** is sized and con-

figured to be inserted into a hole formed in the bone during surgery. The stem **110** extends a predetermined distance from the bone contact surface **108**. In some embodiments, the stem **110** extends a predetermined distance that is less than, equal to, or greater than a thickness of the body **104**. For example, the stem **110** may extend a distance equal to the distance between the articulation surface **106** and the bone contact surface **108** of the body **104**. The stem **110** may extend at any suitable angle from the bone contact surface **108**. For example, in various embodiments, the stem **110** may extend at an angle of between 0-180 degrees from the bone contact surface **108**.

The stem **110** comprises one or more features configured to provide rotational, translational, and/or pull-out resistance to the stem **110**. In the illustrated embodiment, the stem **110** comprises one or more fins **112a**, **112b**. The fins **112a**, **112b** extend from the bone contact surface **108** and the stem **110**. The fins **112a**, **112b** provide anterior/posterior stability, longitudinal stability, and medial/lateral stability to the implant **102** when the implant **102** is coupled to a bone. The fins **112a**, **112b** are inserted into channels formed in the bone during surgery. For example, in one embodiment, the fins **112a**, **112b** are inserted into fin channels formed in a talus during a talar resectioning procedure. The fins **112a**, **112b** contact the side walls of the channels and maintain the implant **102** in a predetermined position and alignment with respect to the bone. FIG. **4** illustrates a front view of the implant **102**. In some embodiments, the body **104** of the implant **102** defines one or more holes **114a**, **114b** sized and configured to receive a handle therein (not shown) to allow manipulation of the talar implant during implantation.

In some embodiments, the implant **102** is coupled to the bone to provide axial resistance. For example, in one embodiment, the implant **102** is cemented to the bone. The implant may be cemented to the bone at the bone contact surface **108** and/or at the stem **110**. As another example, in one embodiment, the implant **102** is press-fit into a hole formed in the bone. The hole is sized and configured to receive the stem **110** in a press-fit engagement. The implant **102** may be coupled to the bone by any other suitable method and/or any combination of methods, such as, for example, being cemented and press-fit into engagement with the bone.

FIG. **5** illustrates a bottom view of the implant **102**. As shown in FIG. **4**, the stem **110** and the fins **112a**, **112b** extend longitudinally from the bone contact surface **108**. Although two fins **112a**, **112b** are illustrated, it will be recognized that the implant **102** may comprise any number of one or more fins. The fins **112a**, **112b** comprise semi-circular sections extending from the bone contact surface **108** to the stem **110**. Although the fins **112a**, **112b** are illustrated as semi-circular, it will be recognized that the fins may comprise any suitable shape such as, for example, rectangular, triangular, and/or any other suitable shape.

FIG. **6** illustrates a side view of one embodiment of an implant **202** comprising a stem **210** having a spline **218** formed thereon. FIG. **7** illustrates a bottom view of the implant **202**. The implant **202** is similar to the implant **102** described with reference of FIGS. **3-5** above. The implant **202** comprises an implant body **204**. The implant body **204** defines an articulation surface **206** and a bone contact surface **208**. A stem **210** extends longitudinally from the bone contact surface **208**. The stem **210** comprise one or more features configured to provide rotational, translational, and/or pull-out resistance to the implant **202** with respect to a bone.

5

In the illustrated embodiment, the one or more features comprise a spline **218**. The spline **218** comprises a plurality of teeth **220a-220e**. The plurality of teeth **220a-220e** are configured to provide anterior/posterior stability, rotational stability, and medial/lateral stability. In some embodiments, the plurality of teeth **220a-220e** are configured to interface with a plurality of grooves formed in a hole in the bone. The teeth **220a-220e** interface with the grooves formed in the hole to prevent movement and rotation of the implant **202** with respect to the bone.

FIG. **8** illustrates a front view of the implant **202**. The body **204** of the implant **202** may define one or more holes **214a, 214b** sized and configured to couple the implant **202** to one or more additional implants. For example, in some embodiments, the implant **202** comprises a talar dome platform configured to couple to a talus and to receive a talar dome thereon. The plurality of holes **214a, 214b** are configured to receive one or more mating features of the talar dome therein to mate the talar dome to the implant **202**. In other embodiments, the plurality of holes **214a, 214b** may be coupled to an adjacent implant, such as, for example, a tibial implant, to maintain the implant **202** and the adjacent implant in a predetermined spacing/alignment.

FIG. **9** illustrates a side view of one embodiment of an implant **302** comprising a triangular stem **310** having a plurality of serrations **332** formed thereon. FIG. **10** illustrates a bottom view of the implant **302**. The implant **302** is similar to the implant **102** described with reference of FIGS. **3-5** above. The implant **302** comprises an implant body **304**. The implant body **304** defines an articulation surface **306** and a bone contact surface **308**. A stem **310** extends longitudinally from the bone contact surface **308**. The stem **310** comprise one or more features configured to provide rotational, translational, and/or pull-out resistance to the implant **302** with respect to a bone.

The triangular stem **310** comprises a first leg **330a**, a second leg **330b**, and a third leg **330c**. In some embodiments, the plurality of legs **330a-330c** are equally spaced about a circumference of the stem **310**. Each of the plurality of legs **330a-330c** comprises a plurality of serrations **332** formed on an outer edge of the leg **330a-330c**. The stem **310** may be inserted into a hole formed in a bone, such as, for example, a talus. The hole may comprise any suitable shape for receiving the stem **310**, such as, for example, a triangular, square, round, or other cross-sectional shape. The plurality of legs **330a-330c** prevent anterior/posterior motion, rotational motion, and/or medial/lateral motion. The plurality of serrations **332** are configured to provide pull-out resistance to the stem **310**.

FIG. **10** is an angled bottom view of the implant **302**. The angled bottom view illustrates the serrated portions **332** of each of the legs **330a-330c**. The legs **330a-330c** each extend longitudinally from the bone contact surface **308**. In the illustrated embodiment, the legs **330a-330c** are equally spaced about a circumference defined by the stem **310**. In other embodiments, the each of the legs **330a-330c** may be separated from each of the other legs by unequal distances and/or angles. For example, the first leg **330a** may be separated from the second leg by a first angle and from the third leg by a second angle. The second and third legs may be separated by a third angle.

FIG. **11** illustrates a bottom view of the implant **302**. The bottom-view illustrates the triangular, or christmas-tree shape, of the stem **310**. The shape of the stem **310** provides anterior/posterior stability, rotational stability, and medial/lateral stability. In some embodiments, the edges of the legs **330a-330c** are sharp to allow the edges **330a-330c** to bite or

6

dig into a bone to provide further stability. The serrations **332** may also be sharp in order to provide additional stability and pull-out resistance.

FIG. **12** illustrates a front view of the implant **302**. The body **304** of the implant **302** may define one or more holes **314a, 314b** sized and configured to couple the implant **302** to one or more additional implants. For example, in some embodiments, the implant **302** comprises a talar dome platform configured to couple to a talus and to receive a talar dome thereon. The plurality of holes **314a, 314b** are configured to receive one or more mating features of the talar dome therein to mate the talar dome to the implant **302**. In other embodiments, the plurality of holes **314a, 314b** may be coupled to an adjacent implant, such as, for example, a tibial implant, to maintain the implant **302** and the adjacent implant in a predetermined spacing/alignment.

In various embodiments, an implant is disclosed. The implant a body having a bone contact surface and an articulation surface. A stem extends longitudinally from the bone contact surface. At least one fin is coupled to the stem and the body.

In some embodiments, the at least one fin is sized and configured to be received within a channel formed in a bone to prevent anterior/posterior movement, rotational movement, and medial/lateral movement.

In some embodiments, the at least one fin comprises a wedge shaped fin.

In some embodiments, the wedge-shaped fin comprises a first flat edge coupled to the stem, a second flat edge coupled to the body, and an arcuate edge extending from an end of the first flat edge to an end of the second flat edge.

In some embodiments, the implant comprises a first fin located on a first side of the stem and a second fin located on a second side of the fin.

In some embodiments, the body defines at least one instrument hole sized and configured to receive an instrument for deploying the implant therein.

In some embodiments, the stem extends a predetermined distance from the body, and wherein the predetermined distance is less than a thickness of the body.

In some embodiments, the articulation surface is sized and configured to mimic a talar dome.

In various embodiments, an implant is disclosed. The implant comprises a body having a bone contact surface and an articulation surface. A stem extends longitudinally from the bone contact surface. A spline is formed about the stem.

In some embodiments, the spline is sized and configured to be received within a channel formed in a bone to prevent anterior/posterior movement, rotational movement, and medial/lateral movement.

In some embodiments, the spline comprises a plurality of equally spaced teeth disposed about a circumference of the stem.

In some embodiments, the body defines at least one instrument hole sized and configured to receive an instrument for deploying the implant therein.

In some embodiments, the stem extends a predetermined distance from the body, and wherein the predetermined distance is less than a thickness of the body.

In some embodiments, the articulation surface is sized and configured to mimic a talar dome.

In various embodiments, an implant is disclosed. The implant comprises a body having a bone contact surface and an articulation surface. A triangular stem having a first leg, a second leg, and a third leg extends longitudinally from the body. At least one of the first leg, the second leg, or the third leg, defines a plurality of serrations formed thereon.

7

In some embodiments, the triangular stem is sized and configured to prevent rotational movement, anterior/posterior movement, and medial/lateral movement, and wherein the plurality of serrations provide pull-out resistance to the stem.

In some embodiments, each of the first leg, the second leg, and the third leg comprise a sharpened edge.

In some embodiments, the body defines at least one instrument hole sized and configured to receive an instrument for deploying the implant therein.

In some embodiments, the stem extends a predetermined distance from the body, and wherein the predetermined distance is less than a thickness of the body.

In some embodiments, the articulation surface is sized and configured to mimic a talar dome.

Although the subject matter has been described in terms of exemplary embodiments, it is not limited thereto. Rather, the appended claims should be construed broadly, to include other variants and embodiments, which may be made by those skilled in the art.

What is claimed is:

1. An implant, comprising:

a body comprising a bone contact surface and an articulation surface, the bone contact surface being planar;
a stem extending from the at least one bone contact surface, the stem having a longitudinal axis, wherein the stem extends a predetermined distance from the body, and wherein the predetermined distance is less than a thickness of the body; and

at least one fin coupled to the stem and the body, wherein the longitudinal axis and the at least one fin are oriented at an oblique angle relative to the bone contact surface.

2. The implant of claim **1**, wherein the at least one fin is sized and configured to be received within a channel formed in a bone to prevent anterior/posterior movement, rotational movement, and medial/lateral movement.

3. The implant of claim **2**, wherein the at least one fin comprises a wedge shaped fin.

4. The implant of claim **3**, wherein the wedge-shaped fin comprises a first flat edge coupled to the stem, a second flat edge coupled to the body, and an arcuate edge extending from an end of the first flat edge to an end of the second flat edge.

5. The implant of claim **2**, comprising a first fin located on a first side of the stem and a second fin located on a second side of the stem.

6. The implant of claim **1**, wherein the body defines at least one instrument hole sized and configured to receive an instrument for deploying the implant therein.

7. The implant of claim **1**, comprising a biofoam coating formed on the articulation surface of the body.

8. An implant, comprising:

a body comprising a bone contact surface and an articulation surface wherein the articulation surface is sized and configured to mimic a talar dome, and the implant is part of a total ankle replacement, which further comprises a tibial implant having a tibial articulation surface and a tibial stem configured to extend into the tibia, the bone contact surface being planar;

a stem extending from the at least one bone contact surface, the stem having a longitudinal axis; and

at least one fin coupled to the stem and the body, wherein the longitudinal axis and the at least one fin are oriented at an oblique angle relative to the bone contact surface.

8

9. An implant, comprising:

a body comprising at least one bone contact surface and an articulation surface, the bone contact surface being planar;

a stem extending from the at least one bone contact surface, the stem shaped as a circular cylinder having a circumference and further wherein the stem extends a predetermined distance from the body, and wherein the predetermined distance is less than a thickness of the body; and

a spline formed about the stem, the spline comprising a plurality of rectangular teeth extending along the length of the stem, the teeth equally spaced about the entire circumference.

10. The implant of claim **9**, wherein the spline is sized and configured to be received within a channel formed in a bone to prevent anterior/posterior movement, rotational movement, and medial/lateral movement.

11. The implant of claim **10**, wherein the spline and a longitudinal axis of the stem are oriented at an oblique angle relative to the bone contact surface.

12. The implant of claim **9**, wherein the body defines at least one instrument hole sized and configured to receive an instrument for deploying the implant therein.

13. An implant, comprising:

a body comprising at least one bone contact surface and an articulation surface wherein the articulation surface is sized and configured to mimic a talar dome, and the implant is part of a total ankle replacement, which further comprises a tibial implant having a tibial articulation surface and a tibial stem configured to extend into the tibia, the bone contact surface being planar;

a stem extending from the at least one bone contact surface, the stem shaped as a circular cylinder having a circumference; and

a spline formed about the stem, the spline comprising a plurality of rectangular teeth extending along the length of the stem, the teeth equally spaced about the entire circumference.

14. An implant, comprising:

a body comprising a bone contact surface and an articulation surface, the bone contact surface being planar;

a Y-shaped stem having a first leg, a second leg, and a third leg extending from the body a predetermined distance from the body, and wherein the predetermined distance is less than a thickness of the body, the Y-shaped stem having a longitudinal axis, wherein at least one of the first leg, the second leg, or the third leg has an edge having a plurality of serrations formed thereon, and the longitudinal axis is oriented at an oblique angle relative to the bone contact surface, and the edge having the plurality of serrations is parallel to the longitudinal axis.

15. The implant of claim **14**, wherein the Y-shaped stem is sized and configured to prevent rotational movement, anterior/posterior movement, and medial/lateral movement, and wherein the plurality of serrations provide pull-out resistance to the stem.

16. The implant of claim **15**, wherein each of the first leg, the second leg, and the third leg comprise a respective edge, each edge being sharpened, each edge having two of the plurality of serrations with a portion of the sharpened edge parallel to the longitudinal axis therebetween.

17. The implant of claim **14**, wherein the body defines at least one instrument hole sized and configured to receive an instrument for deploying the implant therein.

18. An implant, comprising:

a body comprising a bone contact surface and an articulation surface wherein the articulation surface is sized and configured to mimic a talar dome, and the implant is part of a total ankle replacement, which further comprises a tibial implant having a tibial articulation surface and a tibial stem configured to extend into the tibia, the bone contact surface being planar;

a Y-shaped stem having a first leg, a second leg, and a third leg extending from the body, the Y-shaped stem having a longitudinal axis, wherein at least one of the first leg, the second leg, or the third leg has an edge having a plurality of serrations formed thereon, and the longitudinal axis is oriented at an oblique angle relative to the bone contact surface, and the edge having the plurality of serrations is parallel to the longitudinal axis.

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